

A MONOGRAPH OF THE GENUS CHLOROGALUM

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In the summer of 1937, while collecting in the Sierra Nevada foothills of California, the writer found a plant which was at once recognized as an undescribed species of *Chlorogalum*. This discovery aroused an interest in that genus and led to a desire to obtain certain information not found in any available literature. Each species of *Chlorogalum* is very well characterized, so no need was found for extensive revision of classification in the genus, but since several interesting and important facts regarding the plants have been neglected by authors, the formulation of a general account of the genus seemed desirable.

Since the genus is distinctively Californian, the specimens in California herbaria furnished ample data on which to base descriptions and detailed statements of geographical distribution. In addition, the writer has had opportunity for extensive field study of four of the five species and has grown in cultivation large numbers of the commonest species over a period of several years.

The earlier authors, basing their classification almost entirely on the features evident in dried specimens, showed wide disagreement as to the position of *Chlorogalum* in the Liliaceae. It has been regarded as closely related to genera of various remote regions with climates differing extremely from that of California.

J. G. Baker (2) took *Chlorogalum*, together with *Bowiea* and *Nolina*, to constitute a tribe Chlorogaleae, which he distinguished from the tribe Scilleae by the paniculate rather than racemose inflorescence. The weakness of this distinction as marking two tribes is shown by the presence of both racemose and paniculate inflorescences in *Schoenolirion*. Furthermore, to one familiar with the plants under their native conditions of climate and soil, *Chlorogalum* seems out of place when regarded as a close relative of either *Bowiea* or *Nolina*. So different are those genera in manner of growth and in habitat that one instinctively seeks elsewhere for the natural relationships of *Chlorogalum*.

In a revision of the North American Liliaceae, Sereno Watson (5) considered *Chlorogalum* with "*Schoenolirion*" and *Hastingsia* as composing a subtribe Chlorogaleae of the tribe Phalangieae, the tribe to which *Camassia* was referred in Watson's classification. In the following discussion the name *Schoenolirion* signifies the two western species, *S. album* Dur. (*Hastingsia alba* Wats.) and *S. bracteosum* (Wats.) Jepson (*Hastingsia bracteosa* Wats.).

The possible relationship of Watson's Chlorogaleae to the Asphodeloideae was first indicated by Bentham and Hooker in their "Genera Plantarum." A similar conclusion was reached by Engler (3), who in the "Natürlichen Pflanzenfamilien" places

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Chlorogalum with *Schoenolirion* (used in the sense of Watson but also including *Hastingsia*) and *Hemiphylacus* in the subtribe Chlorogalinae of the tribe Asphodeleae, subfamily Asphodeloideae. This subtribe is placed next to the Odontostominae, consisting of the monotypic Californian genus *Odontostomum*, which probably is related to *Chlorogalum*. However, the only tangible difference in Engler's classification between the Asphodeloideae and the tribe Scilleae of the subfamily Lilioideae is evidently in the "rhizome" of the former as contrasted with the bulb of the latter. In this regard, *Chlorogalum* is definitely out of place with *Hemiphylacus*, which has "lang-knollige Wurzeln," but evidently is related to *Schoenolirion*, which has bulbs much like those of *Chlorogalum*. It is not clear why Engler regarded these bulbous genera as belonging to the Asphodeloideae, especially in view of his placing the evidently related genus *Camassia* in the Scilleae.

Chlorogalum is one of several bulbiferous liliaceous genera which are characteristic of California. All of the five species of the genus occur principally within that state, and only two extend beyond its borders, *C. pomeridianum* being found in southern Oregon and *C. parviflorum* in northern Baja California, Mexico. Within this region all of the species are confined to the cismon-tane areas and to relatively low altitudes. The plants are adapted to a climate characterized by a rainy season, when growth of leaves and roots takes place, and a dry season, when flowering and fruiting occur, leaves and roots wither, and the bulb is protected from excessive drying by the thick coats.

The genus is so markedly characterized by its adaptation to the conditions of a particular region that the writer believes its closest natural relationships are to be found in other western North American genera similar in vegetative features, inflorescence, and flower structure. Four genera seem rather closely related to *Chlorogalum*: *Odontostomum*, *Hesperocallis*, *Schoenolirion*, and *Camassia*. The fact that *Odontostomum* is characteristic of the same geographic region and is strikingly similar to the smaller *Chlorogalum* species in habit suggests a similar ancestry, but that genus is quite distinct in several features of undoubted importance. *Hesperocallis* seems somewhat nearer to *Chlorogalum* in morphological characters, but differs in its much larger tubular perianth with the nerves of the segments more numerous. Its geographic range is also separated, though not widely, from that of *Chlorogalum*.

Camassia and *Schoenolirion* appear to be closer to *Chlorogalum* than are any other genera. That Californian botanists previously have been led to similar conclusions is indicated by the position of *Chlorogalum* near *Schoenolirion* and *Camassia* in both Jepson (4), "Flora of California" and Abrams (1), "Illustrated Flora of the Pacific States." *Chlorogalum* seems to be about equally related to these two genera. The paniculate rather than racemose

inflorescence and the small number of seeds suggest a closer affinity with *Schoenolirion*. However, that genus has a perianth which becomes scarious in fruit, a feature found in neither *Chlorogalum* nor *Camassia*, while in all species of *Chlorogalum* and some of *Camassia*, unlike *Schoenolirion*, the perianth-segments are twisted together over the ovary after anthesis. The present writer considers *Chlorogalum* as a typical member of the Scilleae as that tribe is defined by Engler (3), although it simulates certain species of *Asphodelus* to a remarkable degree.

The species of *Chlorogalum* form a distinct natural group separable from *Schoenolirion* by the non-scarious perianth-segments which become twisted together over the ovary, and from the other closely related genus, *Camassia*, by the one or two seeds in each locule and by the paniculate inflorescence. It is notable that both *Schoenolirion* and to a less extent *Camassia* tend to grow in situations which are wet, at least during the growing season, while no *Chlorogalum* has been observed in places which are subject to flooding at any time.

Each species of the genus is remarkably uniform in certain characters. Only *Chlorogalum pomeridianum*, the commonest and most widely distributed species, exhibits sufficient variation to permit, in the opinion of the writer, the segregation of varieties. No plants have been seen which could not be referred with assurance to one of the five species. While the range of *C. pomeridianum* overlaps that of all the other species in a broad way, detailed field studies show that any two species of the genus are very seldom actually associated. So far as known to the writer, only *C. pomeridianum* and *C. angustifolium* ever grow together. Where the two have been seen together, no plants were found which indicated hybridization. The delimitation of the species is thus subject to none of the difficulties of interpretation encountered in many genera.

On the basis of the characters of the bulb, the species can be divided into two groups. One group consists of a single species, *C. pomeridianum*, which has thick bulb-coats composed of very tough coarse fibers. The remaining four species all have thinner membranous bulb-coats with delicate fibers more or less developed. The characters of *C. grandiflorum*, a species evidently closely related to *C. pomeridianum*, indicate that the nature of the bulb-coat is of subordinate importance as an indication of phylogenetic relationship.

The number of ovules in each of the three locules of the ovary is probably always two. As known to the writer in the field, *Chlorogalum pomeridianum*, *C. grandiflorum*, and *C. angustifolium* invariably have two ovules in each locule. The same is true of *C. purpureum*, but in that species some of the ovules always fail to develop into seeds, a fact which has led to the statement in the original description that there is only one ovule in each cell. Certain herbarium specimens of *C. pomeridianum* and *C. parvi-*

florum seem to show a variable number of seeds, from three to six in each capsule. This is probably a result of failure of some of the ovules to develop rather than an indication of reduction in their number.

It is notable that the species are definitely divided into two groups in regard to flowering, three being vespertine and two diurnal. It is evidently no mere coincidence that the two diurnal species, *C. parviflorum* and *C. purpureum*, are also distinguished by having small flowers with the style longer than the perianth. These differences are so correlated with some difference in general aspect that one is led to suspect that the genus as accepted is composed of two separate lines of descent. At any rate, the two groups of species are so much alike morphologically and so close geographically that their inclusion in a single genus is quite consistent with any generally accepted classification of the Liliaceae.

Apparently only one method of vegetative reproduction occurs in the genus; namely, longitudinal splitting of the bulbs. This is seen frequently in *C. pomeridianum* but is unusual in the other species, reproduction being accomplished almost entirely by seeds. Under conditions of cultivation, *C. pomeridianum* begins to flower from five to seven years after germination of the seeds. It is to be expected that the smaller species require less time to reach maturity.

Although the plants with their large clumps of leaves are of interest in the garden, the flowers of most species of *Chlorogalum* are not sufficiently showy to make them desirable for cultivation. The low-growing coastal variety of *Chlorogalum pomeridianum* is a very attractive plant, however, with the delicate white flowers produced abundantly on the low spreading branches. *Chlorogalum purpureum* is also a beautiful species, with its small blue flowers remaining open all day.

The herbaria where cited specimens are located are indicated as follows: California Academy of Sciences (CA), R. F. Hoover (at present in possession of the writer) (H), Dudley Herbarium, Stanford University (S), University of California, Berkeley (UC), Vegetation Type Map Herbarium, California Forest and Range Experiment Station, Berkeley (VT). For the privilege of studying these specimens, the writer expresses his gratitude.

In the following descriptions the term "stem" is intended to include the axis of the panicle, because the inflorescence is not sharply differentiated from the main stem.

SYSTEMATIC TREATMENT

CHLOROGALUM Kunth, Enum. Pl. 4: 681. 1843; Watson, Proc. Am. Acad. 14: 242. 1879, and Bot. Cal. 2: 159. 1880; Intern. Rules Bot. Nomen. 75. 1906 (*nomen conservandum*); Jepson, Fl. Cal. 1: 269. 1922. *Laothòe* Raf., Fl. Tellur. 3: 53. 1836;

Greene, Leaf. Bot. Obs. 1: 90. 1904; Abrams, Ill. Fl. Pac. St. 1: 413. 1923.

Perennial herbs with tunicated bulbs and paniculate inflorescence. Basal leaves several, linear, elongated, radiately spreading; cauline leaves much reduced, the upper scarious. Pedicels scattered or approximate at intervals along the branches of the panicle, each subtended by a small scarious bract. Perianth white to pink or blue, the segments linear to oblong, persistent in fruit and twisted together above the capsule, with darker mid-vein of three nerves, the separate nerves often obscure. Anthers versatile, on filiform filaments. Style filiform, slightly three-cleft at apex. Fruit a loculicidal capsule, subglobose, often somewhat stipitate. Seeds black, rounded, one or two in each locule.

Type species. *Chlorogalum pomeridianum* (DC.) Kunth.

KEY TO THE SPECIES

- Flowers vespertine; style equalling or shorter than perianth; perianth-segments 8-30 mm. long.
- Leaves strongly undulate, 4-25 mm. broad; perianth-segments linear, 15-30 mm. long.
- Bulb-coats of coarse tough fibers (except in variety); pedicels 5-35 mm. long; style 10-15 mm. long, shorter than perianth 1. *C. pomeridianum*.
- Bulb-coats membranous with delicate fibers; pedicels 2-5 mm. long; style 18-28 mm. long, about equaling perianth 2. *C. grandiflorum*.
- Leaves plane or slightly undulate, 2-5 mm. broad; perianth-segments oblong, 8-12 mm. long 3. *C. angustifolium*.
- Flowers not vespertine; style exceeding perianth; perianth-segments 5-8 mm. long; leaves strongly undulate.
- Bulb-coats dark brown; pedicels averaging shorter than flowers; perianth white or pink 4. *C. parviflorum*.
- Bulb-coats (except the outermost) whitish; pedicels averaging as long as flowers; perianth deep blue .. 5. *C. purpureum*.

1. *CHLOROGALUM POMERIDIANUM* (DC.) Kunth, Enum. Pl. 4: 682. 1843. *Scilla pomeridiana* DC., Cat. Hort. Monsp. 143. 1813; Redouté, Les Liliacées 8: pl. 421. 1816. *Anthericum pomeridianum* Ker, Bot. Reg. 7: pl. 564. 1821. *Phalangium pomeridianum* Sweet, Hort. Brit. ed. 1, 416. 1827; Don in Sweet, Brit. Fl. Gard. ser. 2, pl. 381. 1837. *Laothoe pomeridiana* Raf., Fl. Tellur. 3: 53. 1836.

Bulb 7-15 cm. long, the parenchymatous tissue of the outer scales early disintegrating, leaving heavy dark brown coats of coarse tough fibers which project in a sheathing tuft around the base of the leaves and stem; leaves 6-25 mm. wide, strongly undulate; stem stout, 5-25 dm. tall, with ascending or spreading branches above the base; pedicels slender, of variable length, 5-35 mm. long, on the average about equalling the flowers; perianth-segments linear, 15-23 mm. long, white with purple or greenish mid-vein, at anthesis spreading and recurved; anthers about 2 mm. long; style 10-15 mm. long, definitely exceeded by

the perianth; capsule 5-7 mm. long, short-stipitate; ovules 2 in each locule.

Josephine County, Oregon, to San Diego County, California, west of the Sierra Nevada crest, up to 5000 feet altitude.

OREGON. Josephine County: 5 miles north of Grants Pass, *Abrams* 8679 (S); 4 miles east of Applegate River on Grants Pass—Crescent City road, *Kildale* 8211 (S); Waldo, *Applegate* 7320 (S). Jackson County: hills east of Brownsboro, 1927, *Heckner* (S). CALIFORNIA. Siskiyou County: trail up South Fork Indian Creek to Elk Lick, *Kildale* 8651 (S). Humboldt County: Hupa Valley, *Goddard* 44 (UC); Willow Creek, *Abrams* 7191 (S), 7173 (S). Mendocino County: near Handley's, *McMurphy* 172 (S); Willits, 1906, *Clark* (CA); Cloverdale—Hopland road, *Abrams* 8104 (S). Lake County: Mt. Konocti, 1928, *Blankinship* (CA). Sonoma County: mountains west of Calistoga, 1894, *Kraus* (S); west of Windsor near Russian River, *Heller* 5781 (CA, S). Solano County: Little Oak, 1884, *Jepson* (UC); Benicia, *Eastwood* 10503 (CA). Marin County: Mt. Tamalpais, *Mulliken* 72 (UC). Nevada County: Nevada City, *Eastwood* 566 (CA). Placer County: Gold Run, 1925, *Mitchell* (CA). Amador County: New York Falls, *Hansen* 41 (UC); Agricultural Station, *Hansen* 41 (S); 3 miles west of Ione, *Hoover* 2411 (H); Blakely, *Belshaw* 2464 (VT). Calaveras County: Gwin Mine, 1902, *Jepson* (UC); Mokelumne Hill, *Blaisdell* (CA); Camp Baxter, 1930, *Jussel* (CA). Tuolumne County: Rawhide, *Stinchfield* 101 (S); Mountain Pass, *Hoover* 2440 (H); near Chinese Camp, 1889, *Lemmon* (UC); hill above Muir Gorge, 1919, *Clemens* (CA). Stanislaus County: Arnold, *Carlson* 292 (VT). Merced County: Merced, *Hoover* 617 (H). Mariposa County: Wawona, *J. T. Howell* 173 (CA). Madera County: The Pines, Bass Lake, *Abrams* 4974 (S). Tulare County: Badger, 1892, *T. Brandegee* (UC); Eshom Creek Redwoods, *Dudley* 1384 (S). Contra Costa County: Byron Springs, *Eastwood* 11434 (CA). Alameda County: North Berkeley Hills, *Walker* 610 (UC). San Mateo County: Woodside, 1919, *Walther* (CA). Santa Clara County: Black Mountain, *Elmer* 4563 (CA, S, UC); foothills west of Los Gatos, *Heller* 7513 (UC). Santa Cruz County: Santa Cruz Mountains, *Davis* 114 (UC). Monterey County: Pajaro Hills, *Chandler* 432 (UC). San Luis Obispo County: 4 miles southeast of Huerhuero School, *Lee* 1053 (VT); San Luis Obispo, 1908, *Condit* (UC). Kern County: 10.5 miles west-northwest of Liebre Twins, *Simontacchi* 40 (VT). Santa Barbara County: Prado Ranch, 1913, *Newell* (CA). Ventura County: Conejo Mountain, *Gifford* 218 (VT). Los Angeles County: Sierra Madre, *Abrams* 2634 (S). San Bernardino County: "foothills," 1888, *Parish* (S). Orange County: Laguna, *Abrams* 1782 (S). San Diego County: Escondido, *Meyer* 238 (UC).

Chlorogalum pomeridianum was very early introduced into cultivation in Europe. The original description of *Scilla pomeridiana*

DC. was based on a plant growing in the botanic garden at Montpellier, France. Its native country was not known, but the illustration in Redouté's "Les Liliacées" clearly represents the species under consideration.

This species grows on open hills or plains, or less often, in woods and is common in diverse types of soil over much of the California hill country. Its range is more nearly continuous than collections would indicate. For example, it is common in the Sierra Nevada foothills of Fresno County, though it apparently has not been collected there. Collectors often neglect this species, not because it is inconspicuous, but because the large bulbs and the succulent evanescent flowers make it difficult to prepare good specimens. In warm dry localities the flowering season begins before the end of May, while in the coastal fog-belt it may extend even into September. The properties of the bulbs, which account for the common name "soap plant," are well known.

The flowering habits of this species are worthy of note. Each flower opens only on one day, and then only for a few hours. The flowers burst open suddenly about four o'clock in the afternoon and before nightfall are visited by bees in large numbers. Shortly after dark the perianth-segments fold together and become deliquescent.

1a. *CHLOROGALUM POMERIDIANUM* var. *divaricatum* (Lindl.) Hoover, comb. nov. *Ornithogalum divaricatum* Lindl., Bot. Reg. n. ser. 4: 54. 1841; l.c. 5: pl. 28. 1842. *Chlorogalum divaricatum* Kunth, Enum. Pl. 4: 682. 1843. *Laothoe divaricata* Greene, Leaf. Bot. Obs. 1: 91. 1904.

Stem with widely divaricate branches from the base, 3-6 dm. long and not over 3 dm. high.

Immediate vicinity of the coast in middle California, from Sonoma County to Monterey County.

CALIFORNIA. Sonoma County: Bodega Point, *Eastwood* 4892 (CA). San Francisco County: Bay View Hills, *Eastwood* 354 (CA); Mt. Davidson, *Eastwood* 11431 (CA). Santa Cruz County: Swanton, 1912, *Rich* (S). Monterey County: Pacific Grove, 1905, *Coleman* (S); Cypress Point, *Abrams* 7315 (S); Point Lobos, *McGregor* 52 (S).

Ornithogalum divaricatum was described from a plant grown from a bulb obtained "on the coast of California by Mr. Hindes of the Sulphur exploring expedition." It is here identified with the localized coastal variety of *Chlorogalum pomeridianum* on the basis of the terms in the original description "panicled from the base" and "with straggling branches," distinctive features of this variety.

Although not considered worthy of mention by the more recent authors, the variety *divaricatum* seems genetically distinct from typical *C. pomeridianum*. When the typical form, as represented by plants from the Santa Cruz Mountains, and the vari-

ety, as represented by plants from the Monterey Peninsula, were grown together in the garden over a number of years, each retained its characteristic habit and produced only its own kind from seed. Under garden conditions var. *divaricatum* flowers nearly a month earlier than typical *C. pomeridianum*, but its humid coastal habitat prevents early flowering under natural conditions. Because of its compact habit and consequently less scattered flowers, it is a more attractive plant than typical *C. pomeridianum*.

1b. *CHLOROGALUM POMERIDIANUM* var. *minus* Hoover, var. nov.

Tunicis bulbi plerumque membranaceis; caule erecto, 3 ad 4 dm. alto.

Bulb-coats mostly membranous, with few coarse fibers; stem erect, 3–4 dm. tall.

Foothills above Paskenta, Tehama County, California, on the road to Covelo, in area of serpentine rocks in the chaparral belt, Hoover 4104 (UC 618191, type). This variety, which probably occurs at other localities in the inner North Coast Ranges, was mentioned under the original description of *C. grandiflorum* as possibly belonging to that species. Although the small size of the plant and the less fibrous bulb-coats suggests a relationship to *C. grandiflorum*, this variety is shown by the size of the flowers and the length of the pedicels to belong to *C. pomeridianum*.

2. *CHLOROGALUM GRANDIFLORUM* Hoover, Leaf. West. Bot. 2: 128. 1938.

Bulb 5–7 cm. long, with dark brown membranous coats, the outer coats with delicate fibers; leaves 4–12 mm. wide, undulate; stems 3–6 dm. tall, with ascending or spreading branches; pedicels stout, 2–5 mm. long; perianth-segments linear, 20–30 mm. long, white with purple mid-vein, at anthesis spreading and recurved; anthers 3 mm. long; style 18–28 mm. long, about equalling the perianth, often slightly exserted after anthesis; capsule 5–8 mm. long, short-stipitate.

Sierra Nevada foothills in Tuolumne County, California, at about 1500 feet altitude.

CALIFORNIA. Tuolumne County: 3 miles north of Keystone, Hoover 2364 (UC, type, CA, H, S); 3 miles south of Chinese Camp, Hoover 2558 (H, UC).

This localized species grows in rocky places on openly wooded and brushy hills and appears to be confined to serpentine rocks. It is clearly a close relative of *C. pomeridianum*, although its bulb-coats are more like those of the other species. The flowers are noticeably larger than in any other *Chlorogalum* but are approached in size by those of *C. pomeridianum*. The flowers, which appear in May and June, are vespertine as in that species.

3. *CHLOROGALUM ANGUSTIFOLIUM* Kell., Proc. Cal. Acad. 2: 104, fig. 30. 1863. *Laothoe angustifolia* Greene, Leaf. Bot. Obs. 1: 91. 1904.

Bulb 3–5 cm. long, with reddish brown membranous coats, the coats with very delicate fibers; leaves 2–5 mm. wide, not strongly undulate; stem 3–7 dm. tall, with ascending branches; pedicels slender, 2–3 mm. long; perianth-segments white with greenish yellow mid-vein, oblong, 8–12 mm. long, at anthesis ascending at base and spreading above; anthers 1.5 mm. long; style 3–4 mm. long, included; capsule 4–5 mm. long, sessile or with a very short stipe.

Interior of California, at altitudes of 50 to 1500 feet, from Shasta County southward to Lake County in the Coast Ranges, and to Fresno County on the east side of the Great Valley and in the lower foothills of the Sierra Nevada.

CALIFORNIA. Shasta County: mesas near Redding, *Hall and Babcock 4003* (S, UC). Tehama County: 4 miles south of Cottonwood, *Hoover 1180* (H); between Red Bluff and Payne's Creek, *Eastwood and Howell 1848* (CA); Red Bluff, 1884, *Gans* (S). Glenn County: Artois, *Eastwood and Howell 1885* (CA); Stony Creek, 1884, *Rattan* (S). Mendocino County: hills near Covelo, *Eastwood 15177* (CA, UC). Lake County: Kelseyville, 1928, *Blankinship* (CA); between Clear Lake and Lower Lake, *Kildale 2066* (S). Butte County: 7 miles north of Chico, *Hoover 1167* (H); near Clear Creek, *Heller 11400* (S, UC); plains west of Pentz, *Hall 10302* (CA, UC). Sutter County: Marysville Buttes, *Heller 11400* (CA); Pleasant Grove, *Hoover 2219* (H). Eldorado County: Blue Ravine, 1907, *K. Brandegee* (UC). Amador County: vicinity of Ione, *Braunton 1005* (UC); 3 miles west of Ione, *Hoover 2407* (H). Calaveras County: near Valley Springs, *Stanford 419* (S); near Jenny Lind, *Stanford 995* (S); Wallace 1914, *McMurphy* (S); Milton, *Davy 1229* (UC). Stanislaus County: Knight's Ferry, *Hoover 1027* (H); Warnerville, *Hoover 1041* (H). Merced County: 4 miles south of Snelling, *Hoover 2066* (H); 5.5 miles south-southwest of Snelling, *Belshaw 2011* (VT). Fresno County: Pinedale, *Hoover 986* (H), *3458* (H).

Chlorogalum angustifolium was described from cultivated plants collected at "Shasta" by Veatch. This locality is probably the old settlement of Shasta near the present city of Redding. The plants grow on open rolling hills or plains, never among trees or bushes. The preferred type of soil is a red gravelly clay which is baked as hard as brick during the heat of early summer. The flowering season is from late April to early June. The plants occur in large numbers in many localities but are inconspicuous except in the late afternoon, when the flowers are open.

4. *CHLOROGALUM PARVIFLORUM* Wats., Proc. Am. Acad. 14: 243. 1879. *Laiothoe parviflora* Greene, Leaflet Bot. Obs. 1: 91. 1904.

Bulb 4–7 cm. long, with dark brown membranous coats; leaves 3–9 mm. wide, undulate, roughened in appearance, but not scabrous to the touch; stem 3–9 dm. tall, the branches divaricate;

pedicels often two or more in the axil of each bract, slender, 2–8 mm. long, mostly shorter than the flowers; perianth white or light pink, the segments with dark mid-vein, 7–8 mm. long, apparently sub-rotate; anthers 1.5 mm. long; style 7–9 mm. long, exceeding the perianth; capsule about 4 mm. long, sessile or nearly so, with one or two seeds in each locule.

Western Riverside County, California, to extreme northern Baja California, Mexico, from near sea level to altitudes of about 2000 feet.

CALIFORNIA. Riverside County: Menifee, 1897, *Ella Foster* (Hall 534) (UC). San Diego County: Oceanside, *Parish* 4444 (S); dry ridges between Ramona and Ballena, *Abrams* 3779 (CA, S); near Alpine, *Abrams* 4897 (S); Alpine, 1904, *T. Brandegee* (S, UC); Chollas Valley, 1895, *Stokes* (S); 10 miles east of San Diego, *J. T. Howell* 6635 (CA); San Diego, *Hall* 7455 (S, UC); east of Julian, 1926, *Jones* (S). BAJA CALIFORNIA. San Ysidro, *Schoenfeldt* 3803 (S); hills southwest of Valle Redondo, *Fosberg* 8388 (S).

The specimen on which the description of *Chlorogalum parviflorum* was based was collected in El Cajon Valley, San Diego County by Cleveland. The flowering season of this species is in May and June. According to information received from Mr. Frank F. Gander of the San Diego Natural History Museum, the flowers were open in the morning on a cloudy day. Since the weather has little effect on the flowering of the species which are familiar to the writer, it may be concluded that *C. parviflorum* is diurnal in flowering. The note "flowers open in morning" also accompanies the specimens of *Hall* 7455 cited above.

5. *CHLOROGALUM PURPUREUM* Brandegee, *Zoe* 4: 159. 1893. *Laothoe purpurea* Greene, *Leaf. Bot. Obs.* 1: 91. 1904.

Bulb 2.5–3 cm. long, the outer coat brown, readily separating, containing some delicate fibers, the inner coats white, wholly membranous; leaves undulate, 2–5 mm. wide; stem 2.5–4 dm. tall, with few ascending branches; pedicels slender, 4–10 mm. long, mostly longer than the flowers; perianth deep blue, the segments 5–7 mm. long, recurved; anthers yellow, 1 mm. long; style 5–6 mm. long, exserted; capsule 3 mm. long, short-stipitate.

East side of the Santa Lucia Mountains in Monterey County, California, known only from the vicinity of Jolon at about 1000 feet altitude.

CALIFORNIA. Monterey County: Milpitas Ranch, 1897, *Eastwood* (S); plain west of Jolon, 1895, *Dudley* (S); near Jolon, *J. T. Howell* 6535 (CA), *Hall* 10019 (UC), *Hoover* 4076 (CA, S, UC), 4120 (UC), 1893, *Eastwood* (UC, type).

This very distinct and very local species most closely resembles *C. parviflorum* in most features, although far removed from it geographically. This fact suggests the possibility that the two species may be, from the standpoint of geological history,

relictual descendents of a more widely distributed ancestral form. The collection made by Vortriede in 1892, which is cited first in connection with the original description of *Chlorogalum purpureum*, apparently has been lost. Under the circumstances, it seems logical to accept the Eastwood collection of 1893, on which it is evident that the description was mainly based, as the type.

EXCLUDED SPECIES

Chlorogalum Leichtlinii Baker, Gard. Chron. ser. 2, 1: 689. 1874. = *CAMASSIA LEICHTLINII* (Baker) Wats., Proc. Am. Acad. 20: 376. 1885.

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NOTES ON DRABA IN THE SIERRA NEVADA

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Field and herbarium studies upon the alpine vascular flora of the Sierra Nevada of California have been carried on by the writer during the past several years. In these studies certain observations on the perennial scapose species of the genus *Draba* have been made which are herein recorded.

DRABA ASTEROPHORA Pays. Am. Journ. Bot. 4: 263. 1917.

Draba asterophora has not been recorded in the literature as occurring in California. Mount Rose, Washoe County, Nevada, the type locality, was the sole station known to Payson for the species. This mountain, which adjoins the Lake Tahoe area, is geologically and topographically a part of the Sierra Nevada, and the existence of *D. asterophora* in the latter range adjacent to Mount Rose is to be expected. The collections now available for this species extend the known range slightly into California, but still indicate its apparent restriction to the alpine region adjacent to Lake Tahoe on the east and south.

Draba asterophora is distinct in the field. The obovate to oblanceolate leaves are thick and almost fleshy and are thus readily distinguishable from those of the related *D. Lemmonii*, from which species *D. asterophora* differs also in its cruciform rather than